What Is Claimed Is:

1. An exposure apparatus that performs exposure to an object via a projection optical system, the apparatus comprising:

a stage that is movable in at least directions of three degrees of freedom that include an optical axis direction of the projection optical system and two-dimensional directions within a plane orthogonal to the optical axis while holding the object, and can adjust a position of the object in the optical axis direction;

a first position detection unit that detects position information of the stage in the optical axis direction;

a second position detection unit that detects position information of the stage within the plane orthogonal to the optical axis;

a surface shape detection system that detects information related to a surface shape of a surface subject to exposure of the object held on the stage, prior to the exposure; and

an adjustment unit that adjusts a surface position of the surface subject to exposure of the object by driving the stage based on the detection results of the surface shape detection system and the detection results of the first and second position detection units, when performing exposure to the object.

2. The exposure apparatus of Claim 1, further

comprising:

a measurement unit that measures a best focus position of the projection optical system, wherein

the adjustment unit adjusts a surface position of the

5 surface subject to exposure of the object, using the

measurement results of the measurement unit as a datum.

3. The exposure apparatus of Claim 2 wherein

the measurement unit has an aerial image measurement

10 instrument that is arranged on the stage and measures an aerial

image formed by the projection optical system via a

predetermined measurement pattern that is arranged within the

plane orthogonal to the optical axis of the projection optical

system, measures a change of the aerial image in at least one

15 point within an effective exposure field, with respect to a

change of the position of the stage in the optical axis

direction, and measures the best focus position of the

projection optical system based on the measurement results.

20   4. The exposure apparatus of Claim 1, further

comprising:

an off-axis alignment system that is used to detect

an alignment mark formed on the object, wherein

the surface shape detection system has a focal point

25 position detection system that detects a position of the

surface subject to exposure of the object in the optical axis

direction when the alignment mark is detected by the alignment

system, and detects the information related to the surface

shape of the surface subject to exposure of the object based

on the detection results of the focal point position detection

system and on the detection results of the second position

detection unit when the position of the surface subject to

5   exposure of the object in the optical axis direction is

detected by the focal point position detection system.

     5. The exposure apparatus of Claim 4 wherein

     the focal point position detection system is a multiple

10   focal point position detection system that can severally

detect a position of the surface subject to exposure of the

object in the optical axis direction at each of a plurality

of measurement points on the object by irradiating a

measurement light to the plurality of measurement points and

15   detecting a reflected light reflected off the measurement

points.

     6. The exposure apparatus of Claim 5 wherein

     the surface shape detection system detects a detection

20   origin deviation between the measurement points, and detects

a surface shape of the surface subject to exposure of the object

taking the detection results into consideration.

     7. The exposure apparatus of Claim 1 wherein

25   the surface shape detection system includes an

irradiation system that irradiates an illumination light to

a strip-shaped area that the object held on the stage crosses

by movement of the stage and a photodetection system that

receives a reflected light of the illumination light from the surface subject to exposure of the object when the object crosses the strip-shaped area, and detects the information related to the surface shape of the surface subject to exposure

5   of the object based on a position deviation amount from a datum position of a photodetection position of the reflected light in the photodetection system.

8. The exposure apparatus of Claim 1 wherein

10   the surface shape detection system has an interferometer, and detects the information related to the surface shape of the surface subject to exposure of the object using the interferometer.

15   9. The exposure apparatus of Claim 8 wherein

        the interferometer is an oblique incident interferometer whose lightwave enters the surface subject to exposure of the object from an oblique direction.

20   10. The exposure apparatus of Claim 1 wherein

        the adjustment unit takes into consideration the position information of the stage in the optical axis direction detected by the first position detection unit, when the information related to the surface shape of the surface subject

25   to exposure of the object is detected by the surface shape detection system, and adjusts a surface position of the surface subject to exposure of the object, when performing exposure to the object.

11. The exposure apparatus of Claim 1 wherein

the surface shape detection system detects

information related to a relative position in the optical axis

5   direction between the surface subject to exposure of the object

and a datum plane of the stage, along with the information

related to the surface shape of the surface subject to

exposure.

10   12. The exposure apparatus of Claim 11, further

comprising:

a detection mechanism that can detects a position of

the stage in the optical axis direction via the projection

optical system, wherein

15   prior to the exposure, the adjustment unit specifies

a surface position of the surface subject to exposure of the

object in the optical axis direction, based on the detection

results of the detection mechanism, the information related

to the relative position and the information related to the

20   surface shape of the surface subject to exposure of the object.

13. The exposure apparatus of Claim 12 wherein

the adjustment unit detects a difference between a

detection datum of the detection mechanism and the best focus

25   position of the projection optical system, and adjust a surface

position of the surface subject to exposure of the object

taking the detection results into consideration.

14. The exposure apparatus of Claim 1 wherein

detection of the information related to the surface

position of the surface subject to exposure of the object is

performed in a state where the space between the surface shape

5   detection system and the object is not filled with a liquid,

and

the exposure is performed in a state where the space

between the projection optical system and the object is filled

with a liquid.

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15. A device manufacturing method that includes a

lithography process in which a device pattern is transferred

onto an object using the exposure apparatus according to any

one of Claims 1 to 14.

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16. An exposure method in which exposure is performed

to an object via a projection optical system, the method

comprising:

a detection process in which information related a

20   datum position of the object in an optical axis direction of

the projection optical system is detected, along with

information related to a surface shape of a surface subject

to exposure of the object in the optical axis direction, prior

to exposure; and

25   an exposure process in which exposure is performed

while adjusting a surface position of the surface subject to

exposure of the object based on the detection results.

17. The exposure method of Claim 16, further comprising:

a best focus measurement process in which a best focus position of the projection optical system is measured, prior to the exposure process, wherein

in the exposure process, a surface position of the surface subject to exposure of the object is adjusted using the best focus position of the projection optical system as a datum.

18. The exposure method of Claim 16, further comprising:

a calibration process in which calibration of a detection system is performed prior to the detection process, the detection system detecting the information related to a datum position of the object in the optical axis direction of the projection optical system, along with the information related to the surface shape of the surface subject to exposure of the object in the optical axis direction.

19. The exposure method of Claim 16 wherein

the detection process is performed during detection of an alignment mark formed on the object.

20. The exposure method of Claim 16 wherein

in the detection process, as the information related to the datum position of the object in the optical axis direction, position information of a stage holding the object

in the optical axis direction when the information related to the surface shape of the surface subject to exposure is detected.

5   21. The exposure method of Claim 16 wherein

in the detection process, as the information related to the datum position of the object in the optical axis direction, information related to a relative position in the optical axis direction between a datum plane of the stage 10   holding the object and the surface subject to exposure.

22. The exposure method of Claim 21, further comprising:

a datum plane position detection process in which a 15   position of a datum plane of the stage in the optical axis direction is detected via the projection optical system, prior to the exposure process, wherein

in the exposure process, a surface position of the surface subject to exposure of the object in the optical axis 20   direction is specified, based on the detection results of the datum plane position detection process, the information related to the relative position and the information related to the surface shape of the surface subject to exposure of the object.

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23. The exposure method of Claim 22, further comprising:

a calibration information detection process in which

a datum position of a surface position of the surface subject

to exposure of the object and the best focus position of the

projection optical system are detected as calibration

information, prior to the datum plane position detection

5   process, wherein

in the exposure process, a surface position of the

surface subject to exposure of the object is adjusted taking

the calibration information into consideration.

10   24. The exposure method of Claim 16 wherein

in the exposure process, exposure is performed to the

object in a state where the space between the projection

optical system and the object is filled with a liquid.

15   25. A device manufacturing method that includes a

lithography process in which a device pattern is transferred

onto an object using the exposure method according to any one

of Claims 16 to 24.

20   26. A surface shape detection unit, comprising:

a stage that can hold an object and is movable in a

predetermined direction;

an irradiation system that irradiates an illumination

light to a strip-shaped area that the object held on the stage

25   crosses by movement of the stage;

a photodetection system that receives a reflected

light of the illumination light from a surface subject to

exposure of the object when the object crosses the strip-shaped

area;

a detection unit that detects information related to a surface shape of the surface subject to exposure of the object, based on a position deviation amount from a datum position

5 of a photodetection position of the reflected light in the photodetection system.

27. An exposure apparatus, comprising:

a stage that can hold an object subject to exposure

10 and is movable in a predetermined direction;

a detection unit that has an irradiation system to irradiate an illumination light to a strip-shaped area that the object held on the stage crosses by movement of the stage and a photodetection system to receive a reflected light of

15 the illumination light from a surface subject to exposure of the object when the object crosses the strip-shaped area, and detects information related to a surface shape of the surface subject to exposure of the object based on output of the photodetection system; and

20 a controller that controls the stage so that the object crosses the strip-shaped area, and performs surface position adjustment of the surface subject to exposure of the object based on information of a surface shape of a substantially entire area of the surface subject to exposure of the object,

25 the information being obtained by the object crossing the strip-shaped area once.

28. The exposure apparatus of Claim 27, further

comprising:

an optical system that is used to irradiate an exposure light to the object; and

an immersion mechanism that fills the space between the object and the optical system with a liquid, wherein the detection unit detects the information related to the surface shape of the surface subject to exposure of the object, before the immersion mechanism fills the space between the object and the optical system with a liquid.

29. The exposure apparatus of Claim 28, further comprising:

an alignment system that detects an alignment mark on the object, wherein the alignment system detects the alignment mark on the object before the immersion mechanism fills the space between the object and the optical system with a liquid.

30. The exposure apparatus of Claim 29 wherein the detection unit detects the information related to the surface shape of the surface subject to exposure of the object after the alignment system detects the alignment mark.

31. The exposure apparatus of Claim 29 wherein the detection unit detects the information related to the surface shape of the surface subject to exposure of the object before the alignment system detects the alignment mark.

32. A device manufacturing method that includes a lithography process in which a device pattern is formed on an object using the exposure apparatus according to any one of Claims 27 to 31.

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